

TCU Fan Coil Unit Controller

The TCU Fan Coil Unit Controller is a LONWORKS® network compatible device that provides direct digital control of fan coil units with heating and/or cooling coils, and a single-speed, three-speed or variable-speed fan. The controller is designed for field installation or for mounting by original equipment manufacturers (OEMs). The space comfort set points, occupancy mode and fan speed may be adjusted from the TM-9100 Series Room Command Module, or from a LONWORKS compatible Room Command Module when the controller is connected to a LONWORKS network. The controller complies with the LONMARK® interoperability guidelines for sharing data with other network sensors and devices. Operating variables and parameters can be monitored and adjusted from a LONWORKS compatible supervisory system, including the Metasys® NCM Network Control Module and NAE Network Automation Engine that integrate the fan coil unit controller into a facility-wide network.



2775

Figure 1: TCU Fan Coil Unit Controller



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Figure 2: TM-9160 Room Command Module

Features and Benefits	
<ul style="list-style-type: none"> <input type="checkbox"/> Range of models designed for field and factory installations <input type="checkbox"/> Relay outputs for fan control <input type="checkbox"/> Choice of outputs for heating and cooling control <input type="checkbox"/> 230 VAC or 24 VAC power supply models 	Low-cost installation for a wide range of fan coil unit, radiator and chilled ceiling applications
<ul style="list-style-type: none"> <input type="checkbox"/> Software commissioning tool <input type="checkbox"/> Library of configurations for all models 	Ease of configuration and commissioning
<ul style="list-style-type: none"> <input type="checkbox"/> Multiple modes of operation for various occupancy conditions 	Comfort with economy
<ul style="list-style-type: none"> <input type="checkbox"/> Setpoint and mode override from room command module 	Local control by occupants
<ul style="list-style-type: none"> <input type="checkbox"/> LONWORKS peer-to-peer communications network <input type="checkbox"/> LONMARK Space Comfort Controller Profile 	Interoperability with other LONMARK compliant devices
<ul style="list-style-type: none"> <input type="checkbox"/> LONWORKS network connection to Metasys network controller <input type="checkbox"/> Metasys Dynamic Data Access™ networking capabilities 	Facility-wide control efficiency and cost-effective information sharing
<ul style="list-style-type: none"> <input type="checkbox"/> Standalone operation with default parameters <input type="checkbox"/> Nonvolatile memory (Flash and E²PROM) 	System reliability

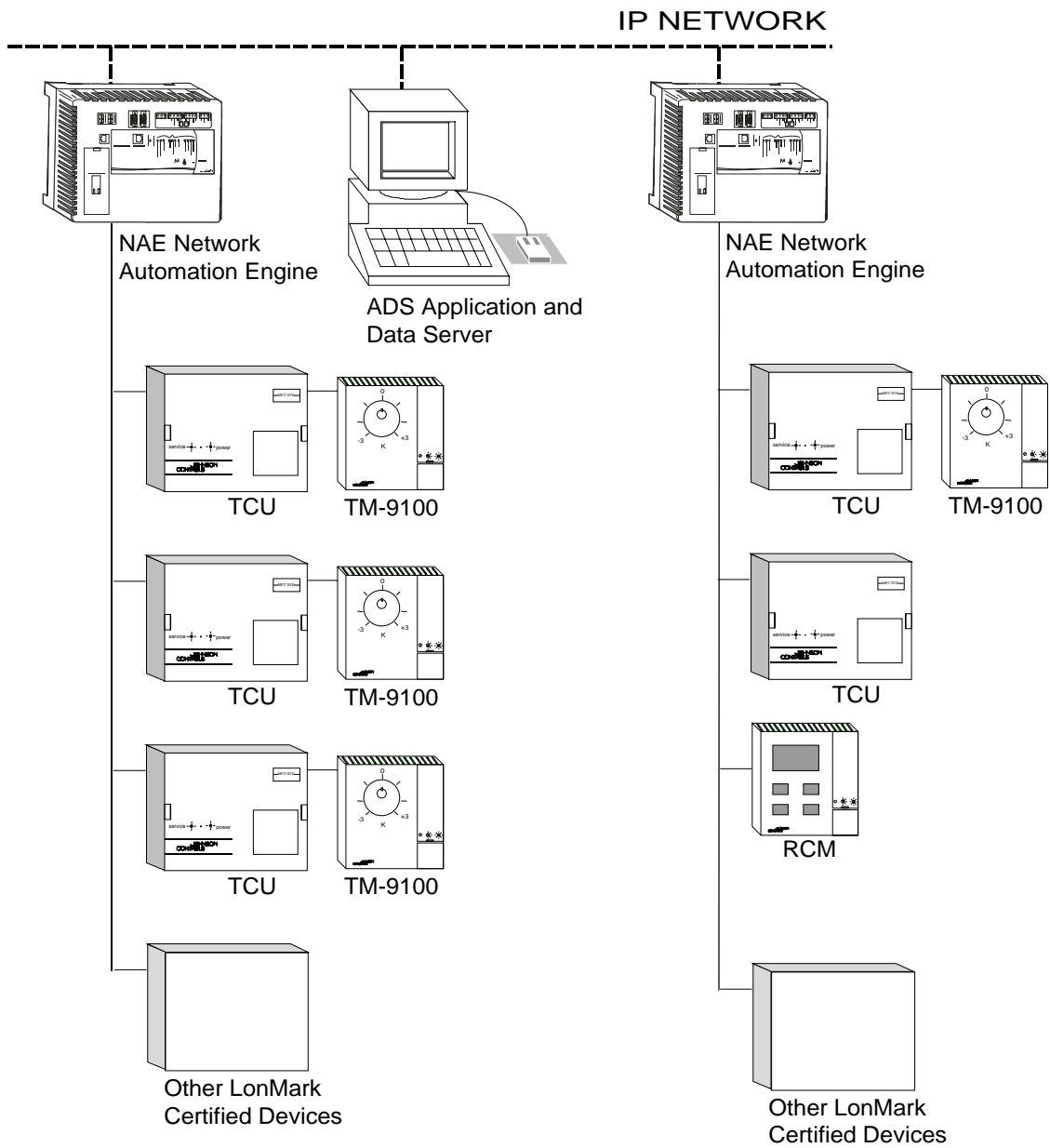


Figure 3: TCU Fan Coil Unit Controller in the Metasys Network

Occupancy Comfort with Economy and Flexibility

The fan coil unit controller offers three modes of operation - occupied (comfort), standby (temporarily unoccupied) and unoccupied (night and weekends). These occupancy modes can be set from an operator workstation or network controller on a Metasys network, from another device on the LONWORKS network or controlled by the room occupants from a local room command module.

In the simplest option, a locally connected TM-9100 room command module provides the occupant with set point and fan speed control, and a button to request the occupied mode. Set point adjustment can be limited within a certain range to allow occupants control over their environment, but not to compromise energy savings.

A second option uses a room command module on the LONWORKS network to set the occupancy mode by occupant command, and the module may have a digital display to show the current room temperature, set point, fan speed and mode of operation. This option gives maximum flexibility to the local occupant and allows

maximum energy savings when there is no supervisory system installed.

Whatever local options are chosen, the controller operating mode can also be scheduled by a Metasys supervisory system or other LONWORKS compatible supervisory system.

A “window open” sensor may be connected to the controller to switch it to the “Energy Hold-off” mode to avoid energy waste. The controller may also be set to “off” by the supervisory network when the space is not in use.

For applications where the cooling coil or pipes are located in the ceiling, a condensation sensor may be connected to switch off cooling if water is condensing on the pipes.

Every controller has a low space temperature detection function as a standard feature that switches on the heating to the maximum value in “Emergency Heat” mode, overriding any other automatic or manual mode of the controller except safety interlocks.

Fan Control Options

In addition to the option of a single-speed, three-speed or variable-speed fan, the controller may also be configured to run the fan only when heating or only when cooling, or to inhibit heating or cooling when the fan is not running.

An option is also available to keep the fan running continuously in occupied and standby modes or to allow the fan to cycle on and off as the space temperature reaches the given setpoint.

Winter/Summer Compensation Feature

When the controller is connected to a network and is receiving the outdoor air temperature value, the room set point may be automatically adjusted on cold winter days or hot summer

days to reduce energy consumption yet maintain occupancy comfort. In winter the set point temperature may be increased to offset the effect of cold surfaces in exterior zones.

Extended Features with Model 2 Firmware

The latest version of firmware for the TCU controller includes extended features for the operation of controllers in a master-slave

relationship and for the connection of multiple occupancy sensors over the LONWORKS network in larger rooms and open areas.

Hardware Configuration to Match Applications

Various controller hardware models are available to match a wide range of fan coil unit, radiator and chilled ceiling control applications. Models are available with 24 VAC or 230 VAC power supply. Each model provides a specific combination of outputs to control heating, cooling and a fan.

All models accept local inputs for the control of occupancy mode, temperature set point, fan speed override and shutoff from a window contact or condensation sensor. The space temperature sensor may be mounted in the fan coil unit or in the room command module.

All hardware modules are available with Model 2 firmware or with the original Model 1 firmware for controller replacement or system extensions.

Table 1: Controller Hardware Output Options

Heating and Cooling Outputs (Single output for 2-pipe applications)	0 to 10 VDC Analog Output (10 mA max.) for Normally Open or Normally Closed valves or: Pair of triacs (24 VAC, 500 mA max., 50mA min.) for: <ul style="list-style-type: none"> • Position Adjust Output (incremental control) • Duration Adjust Output (duration adjust on time cycle) • Single stage on/off • Two-stage on/off (not for 2-pipe applications)
(Certain 230 VAC Models only)	Pair of triacs (230 VAC, 1 A max., 75mA min.) for output types as above.
Fan Control Outputs	Single relay contact for on/off fan (230V, 3A max.) or: Three relay contacts for three-speed fan (230V, 3A max.) or: 0 to 10 VDC Analog Output (10 mA max.) for variable-speed fan.

Note: Refer to *Specifications* for details of available output configurations.

Table 2: Controller Hardware Inputs

Room Temperature Source Temperature (2-pipe) or Discharge Air Temperature	NTC sensor in TM-9100 room command module or mounted in fan coil unit NTC sensor mounted in fan coil unit (JCI NTC sensors, 0 to 100°C, 2252 Ohm at 25°C)
Set Point Adjust Temp. Occupied (Bypass Mode) Fan Speed Override	12 to 28°C or +/-3 K from potentiometer in TM-9100 room command module Push-button in TM-9100 room command module Auto/Off/1/2/3 slide potentiometer in TM-9100 room command module
Condensation Sensor or Heat/Cool switch (2-pipe) Occupancy Sensor Window Sensor	HX-9100-8001 sensor Volt-free contact (closed = COOL) Volt-free contact (closed = occupied) Volt-free contact (closed = window closed)

Ease of Installation

The controller and room command module have separable bases with wiring terminals. The bases are installed first and all the wiring completed and checked before installing the electronic circuits that are located in the controller and room module covers.

This procedure provides the easiest and safest way to install the control system and avoids accidental damage to the electronic circuits when being mounted on the fan coil unit in the factory or on the building site.

Convenient Configuration Setup

The fan coil unit controller is delivered with the appropriate software and hardware configuration and with factory-set parameters such that no on-site programming is necessary to set the fan coil unit into operation.

A software tool is available, however, which runs on a laptop or notebook PC, to enable the installer to adjust operating parameters such as occupancy mode set points and control loop tuning parameters, if required, and to provide online data for the verification of the control sequence. A record of all parameter changes can be stored in memory or on diskette.

Once configured, commissioned, and connected to a network, the controller's operating parameters may be changed from a Metasys operator workstation or other LONWORKS compatible supervisory device.

As the controller is fully LONMARK compliant, it may be connected to any LONWORKS network and configured to communicate with other devices on the network using any LONWORKS compatible network configuration tool. The network variables and configuration properties that are available for interoperability with other LONWORKS compatible devices on the network are listed in tables 3, 4 and 5.

Table 3: Controller Network Variable Inputs

Description	SNVT Name	SNVT Type
Space Temperature Input	nviSpaceTemp	SNVT_temp_p
Space Temp. Setpoint (Absolute)	nviSetpoint	SNVT_temp_p
Space Setpoint Offset	nviSetptOffset	SNVT_temp_p
Space Setpoint Shift	nviSetptShift	SNVT_temp_setpt
Scheduled Occupancy Mode	nviOccSchedule	SNVT_tod_event
Occupancy Mode Override	nviOccManCmd	SNVT_occupancy
Occupancy Sensor Input	nviOccSensor	SNVT_occupancy
Application Mode Input	nviApplicMode	SNVT_hvac_mode
Heat/Cool Mode Input	nviHeatCool	SNVT_hvac_mode
Fan Speed Command	nviFanSpeedCmd	SNVT_switch
Energy Hold Off (Window Open)	nviEnergyHoldOff	SNVT_switch
Water Valve Override	nviValveOverride	SNVT_hvac_overid
Emergency Override	nviEmergOverride	SNVT_hvac_emerg
Water Source Temperature Input	nviSourceTemp	SNVT_temp_p
Outdoor Air Temperature Input	nviOutdoorTemp	SNVT_temp_p
*Condensation Sensor Input	nviCondensation	SNVT_switch
*Heating Input for Slave Operation	nviHeatPriSlave	SNVT_lev_percent
*Cooling Input for Slave Operation	nviCoolPriSlave	SNVT_lev_percent

*Model 2 firmware only

Table 4: Controller Configuration Properties

Description	SCPT Name	SNVT Type
Location Label	nciLocation	SNVT_str_asc
Space Temperature Setpoints	nciSetpoints	SNVT_temp_setpt
Temporary Occupied Time	nciBypassTime	SNVT_time_min
Water Valve Manual Override Time	nciManualTime	SNVT_time_min
Proportional Band for Heating	nciPropBandHtg	SNVT_temp_p
Proportional Band for Cooling	nciPropBandClg	SNVT_temp_p
Integral Action Time for Heating	nciIntTimeHtg	SNVT_time_sec
Integral Action Time for Cooling	nciIntTimeClg	SNVT_time_sec
Send Heartbeat	nciSndHrtBt	SNVT_time_sec
Minimum Send Time	nciMinOutTm	SNVT_time_sec
Receive Heartbeat	nciRcvHrtBt	SNVT_time_sec

SNVT: Standard Network Variable Type

SCPT: Standard Configuration Property Type

Refer to *LONMARK Interoperability Guidelines* for further details.

Table 5: Controller Network Variable Outputs

Description	SNVT Name	SNVT Type
Space Temperature	nvoSpaceTemp	SNVT_temp_p
Effective Setpoint	nvoEffectSetpt	SNVT_temp_p
Controller Unit Status	nvoUnitStatus	SNVT_hvac_status
Effective Occupancy Mode	nvoEffectOccup	SNVT_occupancy
Effective Heat/Cool Mode	nvoHeatCool	SNVT_hvac_mode
Local Setpoint	nvoSetpoint	SNVT_temp_p
Local Setpoint Shift (Summer/Winter Compensation)	nvoSetptShift	SNVT_temp_setpt
Fan Speed Output	nvoFanSpeed	SNVT_switch
Discharge Air Temperature (or Local Water Source Temperature)	nvoDischAirTemp	SNVT_temp_p
Terminal Load Output	nvoTerminalLoad	SNVT_lev_percent
Heating Output	nvoHeatPrimary	SNVT_lev_percent
Cooling Output	nvoCoolPrimary	SNVT_lev_percent
Window Open Sensor	nvoEnergyHoldOff	SNVT_switch
Local Occupancy Sensor	nvoOccSensor	SNVT_occupancy
Space Low Temperature Status	nvoSpaceLowTemp	SNVT_switch
Condensation Sensor	nvoCondensation	SNVT_switch
Sunblind Heat Absorb	nvoSblndAbsorb	SNVT_lev_percent
Sunblind Heat Reflect	nvoSblndReflect	SNVT_lev_percent

SNVT: Standard Network Variable Type

Refer to *LONMARK Interoperability Guidelines* for further details.

Networking Capabilities

As powerful as the controller is by itself, your facility will benefit even more when fan coil unit controllers are integrated into a larger Metasys network. The TCU controller can be connected to a LONWORKS network that is monitored by a Metasys Network Control Module (NCM) or Network Automation Engine (NAE) that can be programmed to provide added energy management and supervisory control capabilities, such as optimal start, demand limiting, trend log, run-time totalization, and more.

The Metasys Dynamic Data Access networking feature makes all information from each controller available throughout the facility. This makes it possible, for example, to reset supply water temperatures based on the load demands of the fan coil unit controllers, and to adjust the room set points based on a common outdoor air temperature for the building or each zone of the building. Dynamic Data Access also makes sensor values, operating status, and any other parameters in the controller available to operators at Metasys workstations anywhere in your facility.

Integrated Room Control

At the local room level, the fan coil unit controller can communicate environmental conditions to other LONMARK certified control devices on the LONWORKS network and receive commands from local operator devices. For example, the controller can send a positioning signal to a sun-blind controller to reflect the sun's energy when the space temperature is above the comfort setpoint. It can also receive an occupancy signal from a motion detector or send a signal to a lighting controller to switch on the lights in the room.

A TCU controller may also be configured as a slave to another TCU controller allowing parallel operation of two or more fan coil units from one room command module and room temperature sensor. This feature allows the flexibility to easily change the assignments of room sensors to controllers when rooms are remodelled or partitions are reconfigured.

Integrated room control provides a fully coordinated system to control the local environment for occupant comfort, using natural sun energy when possible and conserving all sources of generated energy when the room is not occupied.

Open Communications and Interoperability with LONWORKS

When this controller is installed in a fan coil unit, the LONWORKS communication capability means that the unit and its controller can be integrated into a LONWORKS network in your facility at any time. LONWORKS is an open standard for field communications, and interoperability with other

LONWORKS compatible devices is assured by the LONMARK Interoperability Guidelines. Using the LONWORKS technology in the Metasys system allows you to integrate third party controllers and devices into the facility-wide management system.

Specifications

TM-9100 Series Room Command Modules

Product	<i>Room Command Modules / Temperature Sensors</i>
	TM-9150 Series Without set point dial
	TM-9160 Series With set point dial and optional fan speed override
	TM-9170 Series As TM-9160, but without NTC Temperature Sensor
	TM-9190 Series As TM-9160, but without temporary occupied (bypass) button
	TE-9100-8501 Unit Mount NTC Temperature Sensor
Supply Voltage	Powered from TCU Series Controller
Ambient Operating Conditions	0° to 40°C 10 to 90% RH Noncondensing
Ambient Storage Conditions	-20° to 70°C 10 to 95% RH Noncondensing
Dimensions (H x W x D)	80 x 80 x 33 mm
Shipping Weight	0.15 kg
Terminations	Screw Terminals for max. 2 x 1.5 mm ² wires

Specifications

TCU Fan Coil Unit Controller

Product Order Codes	<i>TCU Series Fan Coil Unit Controller</i>		
	<i>24 VAC Models</i>	<i>230 VAC Models</i>	<i>Output Configuration</i>
	AD-TCU1205-x	AD-TCU5205-x	2 x Analog and 1 x Relay
	AD-TCU1215-x	AD-TCU5215-x	2 x Triac (24 V), 1 x Analog and 1 x Relay
	AD-TCU1225-x	AD-TCU5225-x	4 x Triac (24 V) and 1 x Relay
	AD-TCU2205-x	AD-TCU6205-x	2 x Analog and 3 x Relay
	AD-TCU2215-x	AD-TCU6215-x	2 x Triac (24 V), 1 x Analog and 3 x Relay
	AD-TCU2225-x	AD-TCU6225-x	4 x Triac (24 V) and 3 x Relay
	-	AD-TCU3245-x	4 x Triac (230 V) and 1 x Relay
	-	AD-TCU4245-x	4 x Triac (230 V) and 3 Relays
	<i>(See Table 1 for ratings.)</i>		
	x = 0 for Model 1 Firmware		
	x = 1 for Model 2 Firmware		
Power Requirements	<i>24 VAC Models</i>	<i>230 VAC Models</i>	
	24 VAC, +/-15%, at 50/60 Hz, 10 VA (+ 60 VA max. for controlled devices) Independent 230 VAC supply for fan motor.	230 VAC, +/-10%, at 50/60 Hz, 12 VA (includes 6 VA max. for controlled devices at 24 V +/- 15%) + 690 VA max. for fan motor	
Ambient Operating Conditions	0° to 50°C 10 to 90% RH Noncondensing		
Ambient Storage Conditions	-20° to 70°C 10 to 95% RH Noncondensing		
Dimensions (H x W x D)	AD-TCU12xx-xxxx / AD-TCU22xx-xxxx: 122 x 144 x 38 mm / 4.8 x 5.7 x 1.5 in. AD-TCU32xx-xxxx / AD-TCU42xx-xxxx: 122 x 144 x 51 mm / 4.8 x 5.7 x 2.1 in. AD-TCU52xx-xxx / AD-TCU62xx-xxxx: 122 x 144 x 51 mm / 4.8 x 5.7 x 2.1 in.		
Shipping Weight	AD-TCU12xx-xxxx / AD-TCU22xx-xxxx: 0.38 kg / 14 oz. AD-TCU32xx-xxxx / AD-TCU42xx-xxxx: 0.5 kg / 1 lb. 2 oz. AD-TCU52xx-xxxx / AD-TCU62xx-xxxx: 0.65 kg / 1 lb. 7 oz.		
LONWORKS Communication	Free Topology Transceiver FTT-10a, 78 kbps Service Pin and Service LED provided		
Terminations	Screw Terminals for max. 2 x 1.5mm ² wires		
CE Compliance	Directive 89/336/EEC EN 50081-1, EN 50082-1 Directive 73/23/EEC EN 60730		
External Interface File	JCSCCFU.XIF- Model 1 Firmware JCSCCF2.XIF- Model 2 Firmware (See <i>Product Order Codes</i>)		



LONMARK® 3.2

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products, and reserves the right to change or supplement the contents of this publication.

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